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STAT430 Online Assigment 8

Question 1: Based on the pplots from both breeds' CA levels, there does not seem to be major

deviations from normality. From the Boxplots of both breeds' CA levels, there does not seem to

be any outliers. So it is reasonable to use the t procedures.

Question 2: (Code)

PROC TTEST DATA = PIGS SIDES = 2 ALPHA = 0.05;

CLASS BREED;

VAR CALCIUM;

RUN;

PROC NPAR1WAY DATA = PIGS WILCOXON;

CLASS BREED;

VAR CALCIUM;

EXACT WILCOXON;

RUN;

Question 3: (Output of SAS)

| **Obs** | **BREED** | **CALCIUM** | **PHOSPHATE** |
| --- | --- | --- | --- |
| **1** | CHESTER | 116 | 47 |
| **2** | CHESTER | 112 | 48 |
| **3** | CHESTER | 82 | 57 |
| **4** | CHESTER | 63 | 75 |
| **5** | CHESTER | 117 | 65 |
| **6** | CHESTER | 69 | 99 |
| **7** | CHESTER | 79 | 97 |
| **8** | CHESTER | 87 | 110 |
| **9** | HAMPHIRE | 62 | 230 |
| **10** | HAMPHIRE | 59 | 182 |
| **11** | HAMPHIRE | 80 | 162 |
| **12** | HAMPHIRE | 105 | 78 |
| **13** | HAMPHIRE | 60 | 220 |
| **14** | HAMPHIRE | 71 | 172 |
| **15** | HAMPHIRE | 103 | 79 |
| **16** | HAMPHIRE | 100 | 58 |

**The UNIVARIATE Procedure**

**Variable: PHOSPHATE**

**BREED = CHESTER**

| **Moments** | | | |
| --- | --- | --- | --- |
| **N** | 8 | **Sum Weights** | 8 |
| **Mean** | 74.75 | **Sum Observations** | 598 |
| **Std Deviation** | 24.5575127 | **Variance** | 603.071429 |
| **Skewness** | 0.2835452 | **Kurtosis** | -1.7436424 |
| **Uncorrected SS** | 48922 | **Corrected SS** | 4221.5 |
| **Coeff Variation** | 32.8528598 | **Std Error Mean** | 8.68239187 |

| **Basic Statistical Measures** | | | |
| --- | --- | --- | --- |
| **Location** | | **Variability** | |
| **Mean** | 74.75000 | **Std Deviation** | 24.55751 |
| **Median** | 70.00000 | **Variance** | 603.07143 |
| **Mode** | . | **Range** | 63.00000 |
|  |  | **Interquartile Range** | 45.50000 |

| **Tests for Location: Mu0=0** | | | | |
| --- | --- | --- | --- | --- |
| **Test** | **Statistic** | | **p Value** | |
| **Student's t** | **t** | 8.609379 | **Pr > |t|** | <.0001 |
| **Sign** | **M** | 4 | **Pr >= |M|** | 0.0078 |
| **Signed Rank** | **S** | 18 | **Pr >= |S|** | 0.0078 |

| **Quantiles (Definition 5)** | |
| --- | --- |
| **Level** | **Quantile** |
| **100% Max** | 110.0 |
| **99%** | 110.0 |
| **95%** | 110.0 |
| **90%** | 110.0 |
| **75% Q3** | 98.0 |
| **50% Median** | 70.0 |
| **25% Q1** | 52.5 |
| **10%** | 47.0 |
| **5%** | 47.0 |
| **1%** | 47.0 |
| **0% Min** | 47.0 |

| **Extreme Observations** | | | |
| --- | --- | --- | --- |
| **Lowest** | | **Highest** | |
| **Value** | **Obs** | **Value** | **Obs** |
| 47 | 1 | 65 | 5 |
| 48 | 2 | 75 | 4 |
| 57 | 3 | 97 | 7 |
| 65 | 5 | 99 | 6 |
| 75 | 4 | 110 | 8 |

Chart

Description automatically generated

**The UNIVARIATE Procedure**

**Variable: PHOSPHATE**

**BREED = HAMPHIRE**

| **Moments** | | | |
| --- | --- | --- | --- |
| **N** | 8 | **Sum Weights** | 8 |
| **Mean** | 147.625 | **Sum Observations** | 1181 |
| **Std Deviation** | 67.1840489 | **Variance** | 4513.69643 |
| **Skewness** | -0.2414963 | **Kurtosis** | -1.7786896 |
| **Uncorrected SS** | 205941 | **Corrected SS** | 31595.875 |
| **Coeff Variation** | 45.50994 | **Std Error Mean** | 23.7531483 |

| **Basic Statistical Measures** | | | |
| --- | --- | --- | --- |
| **Location** | | **Variability** | |
| **Mean** | 147.6250 | **Std Deviation** | 67.18405 |
| **Median** | 167.0000 | **Variance** | 4514 |
| **Mode** | . | **Range** | 172.00000 |
|  |  | **Interquartile Range** | 122.50000 |

| **Tests for Location: Mu0=0** | | | | |
| --- | --- | --- | --- | --- |
| **Test** | **Statistic** | | **p Value** | |
| **Student's t** | **t** | 6.214966 | **Pr > |t|** | 0.0004 |
| **Sign** | **M** | 4 | **Pr >= |M|** | 0.0078 |
| **Signed Rank** | **S** | 18 | **Pr >= |S|** | 0.0078 |

| **Quantiles (Definition 5)** | |
| --- | --- |
| **Level** | **Quantile** |
| **100% Max** | 230.0 |
| **99%** | 230.0 |
| **95%** | 230.0 |
| **90%** | 230.0 |
| **75% Q3** | 201.0 |
| **50% Median** | 167.0 |
| **25% Q1** | 78.5 |
| **10%** | 58.0 |
| **5%** | 58.0 |
| **1%** | 58.0 |
| **0% Min** | 58.0 |

| **Extreme Observations** | | | |
| --- | --- | --- | --- |
| **Lowest** | | **Highest** | |
| **Value** | **Obs** | **Value** | **Obs** |
| 58 | 16 | 162 | 11 |
| 78 | 12 | 172 | 14 |
| 79 | 15 | 182 | 10 |
| 162 | 11 | 220 | 13 |
| 172 | 14 | 230 | 9 |

Chart

Description automatically generated

**The TTEST Procedure**

**Variable: PHOSPHATE**

| **BREED** | **Method** | **N** | **Mean** | **Std Dev** | **Std Err** | **Minimum** | **Maximum** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CHESTER** |  | 8 | 74.7500 | 24.5575 | 8.6824 | 47.0000 | 110.0 |
| **HAMPHIRE** |  | 8 | 147.6 | 67.1840 | 23.7531 | 58.0000 | 230.0 |
| **Diff (1-2)** | **Pooled** |  | -72.8750 | 50.5805 | 25.2902 |  |  |
| **Diff (1-2)** | **Satterthwaite** |  | -72.8750 |  | 25.2902 |  |  |

| **BREED** | **Method** | **Mean** | **95% CL Mean** | | **Std Dev** | **95% CL Std Dev** | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CHESTER** |  | 74.7500 | 54.2194 | 95.2806 | 24.5575 | 16.2368 | 49.9812 |
| **HAMPHIRE** |  | 147.6 | 91.4577 | 203.8 | 67.1840 | 44.4204 | 136.7 |
| **Diff (1-2)** | **Pooled** | -72.8750 | -127.1 | -18.6328 | 50.5805 | 37.0313 | 79.7704 |
| **Diff (1-2)** | **Satterthwaite** | -72.8750 | -130.2 | -15.5040 |  |  |  |

| **Method** | **Variances** | **DF** | **t Value** | **Pr > |t|** |
| --- | --- | --- | --- | --- |
| **Pooled** | Equal | 14 | -2.88 | 0.0121 |
| **Satterthwaite** | Unequal | 8.8377 | -2.88 | 0.0185 |

| **Equality of Variances** | | | | |
| --- | --- | --- | --- | --- |
| **Method** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Folded F** | 7 | 7 | 7.48 | 0.0165 |

**The NPAR1WAY Procedure**

| **Wilcoxon Scores (Rank Sums) for Variable PHOSPHATE Classified by Variable BREED** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **BREED** | **N** | **Sum of Scores** | **Expected Under H0** | **Std Dev Under H0** | **Mean Score** |
| **CHESTER** | 8 | 47.0 | 68.0 | 9.521905 | 5.8750 |
| **HAMPHIRE** | 8 | 89.0 | 68.0 | 9.521905 | 11.1250 |

| **Wilcoxon Two-Sample Test** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Statistic (S)** | **Z** | **Pr < Z** | **Pr > |Z|** | **t Approximation** | | **Exact** | |
| **Pr < Z** | **Pr > |Z|** | **Pr <= S** | **Pr >= |S-Mean|** |
| **Z includes a continuity correction of 0.5.** | | | | | | | |
| 47.0000 | -2.1529 | 0.0157 | 0.0313 | 0.0240 | 0.0480 | 0.0141 | 0.0281 |

| **Kruskal-Wallis Test** | | |
| --- | --- | --- |
| **Chi-Square** | **DF** | **Pr > ChiSq** |
| 4.8640 | 1 | 0.0274 |